DE LA SALLE UNIVERSITY - MANILA
COLLEGE OF SCIENCE
Mathematics Department

# SYLLABUS

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|---|---|
| COURSE CODE | MSS601M |
| COURSE TITLE | Stochastic Processes |
| CLASS DAY & TIME | |
| ROOM | |
| NAME OF FACULTY | |
| COURSE CREDIT | 3 units |
| CONTACT NO. (DEPT) | 536-0270, 524-4611, loc. 420 |
| TERM/SCHOOL YEAR | |

## COURSE DESCRIPTION
A course on Poisson process, renewal theory, Markov chains, continuous time Markov chains, and martingales.

## PREREQUISITES:
Introduction to Probability Theory

## COURSE OBJECTIVES
1. Introduce students to various random processes
2. Help students acquire the skills needed to analyze and understand models/ applications of these processes.

| Topic/ Subtopic | Learning Strategies /Activities | Week/ Meeting |
|---|---|---|
| **1. Markov Chains**<br>1.1 Introduction<br>1.2 Chapman-Kolmogorov Equations and Classification of States<br>1.3 Limit Theorems<br>1.4 Transitions, the Gambler's Ruin Problems and Transient States<br>1.5 Branching Processes<br>1.6 Applications of Markov Chains<br>1.7 Time-Reversible Markov Chains<br>1.8 Semi-Markov Processes | Lecture<br>Facilitated group discussion<br>Problem solving | 2 Hours |
| **2. Continuous-Time Markov Chains**<br>2.1 Introduction<br>2.2 Continuous-Time Markov Chains<br>2.3 Birth and Death Processes<br>2.4 The Kolmogorov Differential Equations | Lecture<br>Facilitated group discussion<br>Problem solving | 3 Hours |

| Topic/ Subtopic | Learning Strategies /Activities | Week/ Meeting |
|---|---|---|
| 2.5 Limiting Probabilities<br>2.6 Time Reversibility<br>2.7 Applications of the Reversed Chain to Queuing Theory<br>2.8 Uniformization | | |
| **3. The Poisson Process**<br>3.1 Introduction<br>3.2 Inter-arrival and Waiting Time Distributions<br>3.3 Conditional Distribution of the Arrival Times<br>3.4 Non-homogeneous Poisson Process<br>3.5 Compound Poisson Random Variables and Processes | Lecture<br>Facilitated group discussion<br>Problem solving | 3 Hours |
| **4. Renewal Theory**<br>4.1 Introduction<br>4.2 Distribution of N(t)<br>4.3 Some Limit Theorems<br>4.4 The Key Renewal Theory and Applications<br>4.5 Delayed Renewal Processes<br>4.6 Renewal Reward Processes<br>4.7 Regenerative Processes<br>4.8 Stationary Point Processes | Lecture<br>Facilitated group discussion<br>Problem solving | 3 Hours |
| **5. Martingales**<br>5.1 Introduction<br>5.2 Stopping Times<br>5.3 Azuma's Inequality for Martingales Convergence theorem<br>5.4 A Generalized Azuma Inequality | Lecture<br>Facilitated group discussion<br>Problem solving | 2 Hours |

## TEACHING STRATEGIES/METHODOLOGY

1. Lecture
2. Report

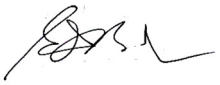
## REQUIREMENTS OF THE COURSE

1. Examinations / Reports
2. Learning Output – critique of a paper

## REFERENCES


- Ross, S. M. (1996 ). *Stochastic Processes, 2/e.* John Wiley & Sons, New York.
- Kao, E. P.C. (1997). *Introduction to Stochastic Processes*. Duxbury Press, Belmont.
- Serfozo, R. (2009). *Basics of Applied Stochastic Processes*. Springer, Berlin.
- Shorack, G.R. (2000). *Probability for Statisticians.* Springer-Verlag, New York.
- Oloffson, P. (2005). *Probability, Statistics and Stochastic Processes.* Wiley-InterScience, New Jersey.
- Beichelt, F. (2002). *Stochastic Processes and their Applications.* Taylor & Francis, London.
- Berger, M. (1993). An Introduction to Probability and Stochastic Processes. Springer-Verlag, New York.

Noted by



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